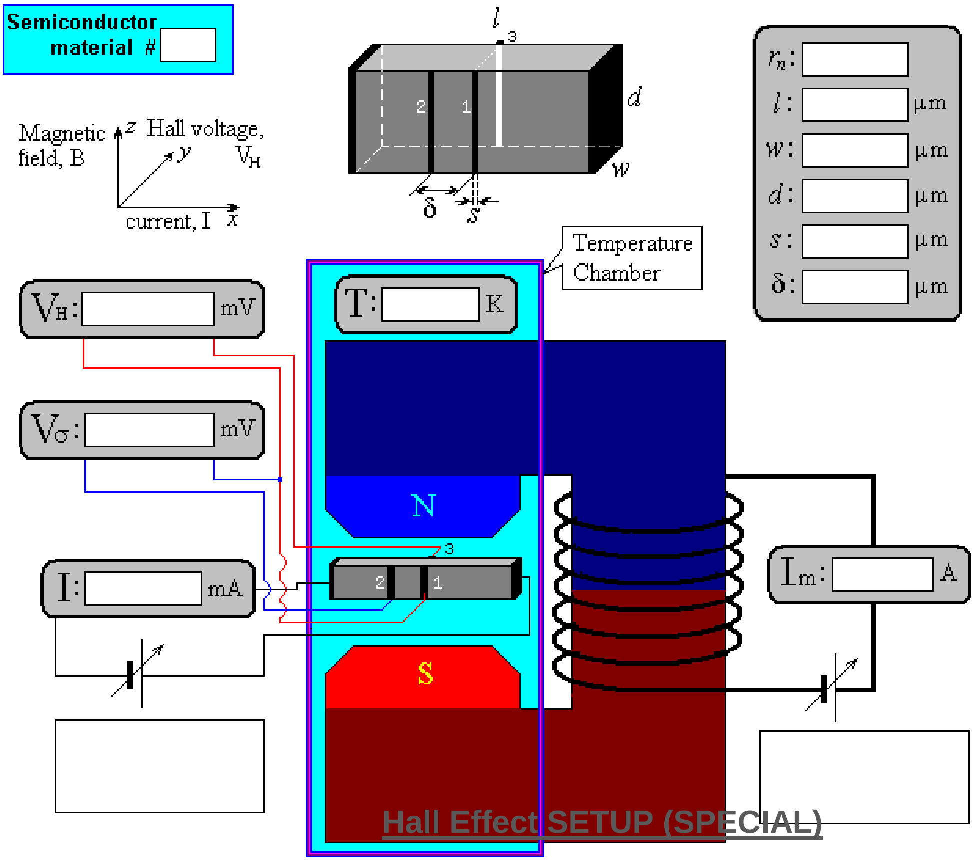
Experiment # 4

Hall Effect

Hall EFFECT K IT (Special)

Specifications

1. **ELECTROMAGNET**	:	Pole Diameter	: 30 mm
		Plate gap	: 0-50 mm adjustable Magnetic Field : 5000 O e in 10 mm, pole gap
		Energising –current	: 2000 mA DC max.
2. **HALL PBOBE**	:	Material	: Indium Arsenide
		Crystal Size	: 5 mm X 2 mm X 0 .1 mm (approx.)
		Sensitivity	: 5 mV /100 mA / K0e
3. **Control Unit**	:	Main Supply	: 230V 50 Hz 1 Ph
		OUTPUT	: 0-2000 mA DC for magnet 40-100 ma DC for HALL PROBE
		Indication	: 2000 mA DC for current
			20 mV DC for Probe Output
4. **GAUSSMETER**	:	Sensor Ranges	: 1mm thick Hall Probe & 20 KOE
			& 2 KOE on 3.5 digit



Hall Effect SETUP (SPECIAL)

CONTROL UNIT

1. The 3.5 digit meter on left .is calibrated to read 0-2000 mA DC. Ehen -METER SELECT switch is kept in MAGNET position, it reads electromagnet current and when kept in PBOBE position it reads probe current. Electromagnet or Probe current though not shown on meter s till comes at the respective terminals.
2. SET CURRENT at l e f t is used to adjust electromagnet current.
3. PROBE CURRENT control adjusts probe excitation current.
4. PROBEERO controls nullifies any offset voltage of probe.
5. The 3.5 digit meter in center is calibrated to read 0-20 mV DC. And is used to read Probe Output voltage.
6. FOR/REV switch reverses the polarity of probe current.
7. The 3.5 digit meter at Tight is calibrated to read Gauss meter Probe current in 'CAL position and 0-20 K Gauss or 0-2 K Gauss' in the respective switch positions. CAL &ERO Controls at right are for use with Gauss meter only.
8. 'Hall Probe for Gauss meter is marked with CAL. CONST and that for HALL EFFECT EXPT. is marked with CAL. CURRENT. The probes should not be interchanged.

Hall Effect DEMONSTRATION KIT

The hall effect can be described as the appearance of EMF across width of the conductor when a current flows along its length and magnetic field exists perpendicular to the plane of Hall conductor If a current I_c passed along the length of the conductor of thickness t and placed in a magnetic field, B perpendicular to the plane of the Hall Plate' a Potential difference V_h in developed across the width of the Plate and in represented by $V_h = (R_h/t) \times B \times I_c \times 10^{-8}$

Where R_h in Hall Coefficient of crystal material in cm^3/coulomb and is a characteristic of the material of the Hall plate. For given plate, R_h & t are constant. Hence above equation can be written an $V_h = K \times B \times I_c$

Thus if I_c in kept constant, V_b becomes the measure of magnetic field. This forms the basis of GAUSS Meter for magnetic field measurement. Also many other parameter& either electrical or. Mechanical can be converted into .either magnetic field or HAII plate Current. As such these parameters can be measured with the help of HALL PLATE.

CALCULATION OF HALL COEFFICIENT

$R_h = (V_h \times t \times 10^8) / B \times I_c$

SOME APPLICATIONS

ANGULAR DISPLACEMENT: Actually V_h in a trigonometric function of B and in represented by equation $V_h = K \times B.\sin\theta$ where θ is the angle Plane of the plate makes with the magnetic field.

DC CURRETN SENSOR: If a loop of magnetic material in put around a conductor carrying current A, the magnetic field Produced in a gap of this loop is proportional to A. Hence by measuring magnetic field will also give a measure of current A through the conductor.

DC WATTMETER: If a loop of magnetic material is put around main current wire, the magnetic field created in a gap in the loop is Proportional to Current A. If the system voltage is fed through an appropriate resistor to Hall plate, then Hall Current in Proportional to System Voltage. Thus The Hall Output will be a Product of System Voltage & Current.

SETUP THE INSTRUMENT

1. Connect Electromagnet to MAGNET terminal
2. Connect Hall Probe into the socket provide on the panel.
3. Keep magnet current control and Probe current control in maximum anticlockwise position.
4. Plug the instrument into 230V 50Hz 1ph MAINS Supply switch ON.

EXPERIMENT: PROBE CURRENT AGAINST PROBE OUTPUT CHARACTERISTICS

1. Keep CURRENT selector' switch in MAGNET position and set the magnet current at any desired value. Note down the currant and do not disturb this control till one set of reading is complete.

2. Now keep the CURRENT selector switch in Probe position. The meter will indicate some current. The probe output meter may show some reading. Adjust ZERO control till probe output meter reads zero.

3. Carefully insert the probe through the plastic nut provided on the top of the electromagnet and screw it so that the plane of the plate is p parallel to the face of the pole pieces. Now the plane of the crystal will be at right angles to the direction of magnetic field. To adjust very accurately, slowly turn the probe till the probe output meter reads maximum reading. Do not disturb the probe till end of experiment.

4. Note down the value of probe output for 'Various values of Probe current

5. Repeat the procedure for different values of magnetic field.

EXPERIMENT: MAGNETIC FIELD AGAINST PROBE OUTPUT CHARACTERISTICS

1. Keep the CURRENT Selector switch in Probe position and set Probe current at any desired value

2. Now keep CURRENT .selector switch in MAGNNT position. Note down the values of Probe output for various settings of Magnetic field. A chart showing the correlation between magnet current and corresponding field is given. Note that the magnetic field for increasing current and the decreasing current are slightly different due to Hysteresis of material

3. Repeat the procedure for various values of probe current setting.

NOTE: If the pole gap is reduced, the magnetic field will increase and vice versa. The calibration chart is for 10 mm pole gap. The probe when used at its calibration current gives an output of 5 mV for 1000 Gauss magnetic field.

GAUSS METER TYPE G-11 & DIGITAL

These Gauss meters are suitable for measurements of D.C (Steady) magnetic fields. The thin HALL probe makes it Possible to` measure the fields in narrow gaps not less than 11.6 mm wide

Precaution: HALL probe is very delicate & fragile. Any undue Pressure like rubbing against a hard surface will permanently damage the crystal: Utmost care should be taken while handling the Probe. When not in use clear protection cover must be put on.

OPERATING INSTRUCTIONS:

1. Connect HALL probe into the socket provided on the front Panel

2. Keep range switch in CAL Position.

3. Connect the instrument to appropriate MAINS supply end switch ON the instruments. Allow 10 minutes warm- UP time before use'.

4. Adjust CAL control so that the meter reads the value marked on the HALL probe. For type G-II, it is the Percentage of full scale.

5. Move RANGE switch to IK position for G-1.1 and 2K Position for DIGITAL. Adjust ZERO control (Coarse & Fine) for DIGITAL so that the meter reads ZERO. Now the instrument is set and these control must not be disturbed.

6. Instrument is now ready for measuring the magnetic fields. A1wa3 use the highest range first and progressively move to lower one.

Experiment #5

High frequency characteristics of BJT

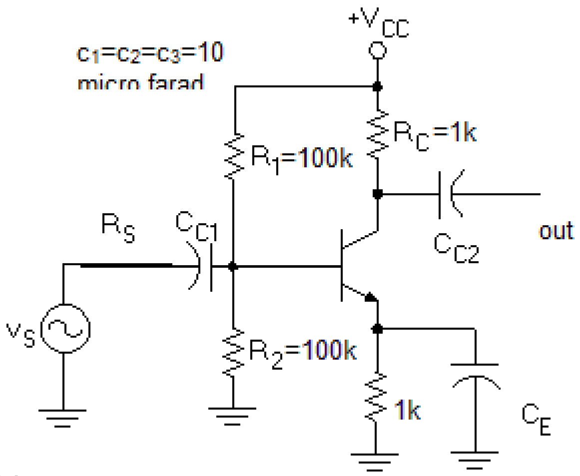
The aim of this experiment is to explore the high frequency operation of an n-p-n bipolar junction transistor and define its operating frequency range. The high frequency model the given circuit is to be analyzed.

Component Required:

BJT BC-547, Resistors 100k- 2nos & 1K- 2nos, Capacitor 10Micro farad - 3nos

Facilities Required:

Breadboard, Variable Power Supply, Multimeter, oscilloscope



Building the Circuit

1. Turn the supply power oil before you build anything!

2. Make sure the power is off before you build anything'.

3. Connect the + 12V and ground ((GND) leads of the power supply to the power and ground bus strips on your breadboard before connecting up, use a voltmeter to check that the voltage does not exceed 12 V

4. Plug the elements (transistor, resistors, and capacitors) into the breadboard 5. Connect +12V and GND pins as shown in circuit to the power and ground bus strips on the breadboard.

6. Apply 50 Hz to 1.5 MHz sinusoidal signal in the input of the circuit and measure the output through CRO

7. Note the input and output signal amplitude and frequency

8. Define the lower and higher cutoff frequency and the operating range of the circuit.

9. Plot frequency response graph and determine lower and higher cut off frequencies

Result

Sl No	Input Voltage	Out Put Voltage	Input Frequency	Gain	Gain in db

Experiment # 6

JEFET Characterization

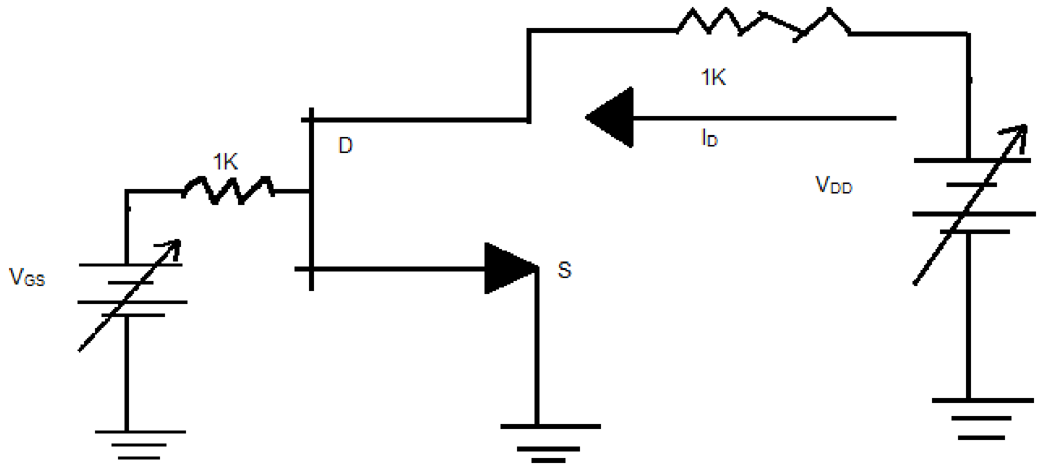
The object of this lab is to investigate the characteristics of JEFET. Both the output and trans-conductance characteristics curve will be investigated.

Component Required:

JEFET (n Chanel) BFW-10/11, Resistors 1K- 2nos

Facilities Required:

Breadboard, Variable Power Supply, Multimeter



Procedure

Measuring ID versus VDS (o/p characteristics)

1. Build the circuit as in fig.
2. Obtain the output characteristics i.e. I_D V_s $V_{DS.}$
3. Set the particular value of voltage for $V_{GS.}$ Vary V_{DD} from 0 to 16 V with step of 0.5 V and measure corresponding $I_{D.}$
4. Reaped the procedure for different values of V_{GS} (0V, -.5V. -1V, -1.5V, -2V)
5. Plot the graph I_D vs. $V_{DS.}$

Transconductance characteristics

The transfer characteristic for a JFET can be determined experimentally, keeping drain-source voltage, V_{DS} constant and determining drain current, I_D for various values of gate-source voltage, V_{GS}.

6. From the fig obtain the Trans conductance characteristics, i.e. I_D vs. $V_{DS.}$
7. Set particular voltage V_{DD} i.e. 5v start with a gate voltage V_{GS} of 0 and measure the corresponding drain current I_D. The decrease V_{GS} in step of .25v until V_{GS} is -3v at each step record the drain current.
8. Plot the graph I_D vs. $V_{DS.}$
9. Calculate the Trans conductance parameter from graph